



TX6377
Sentry



TROLEX

User Manual

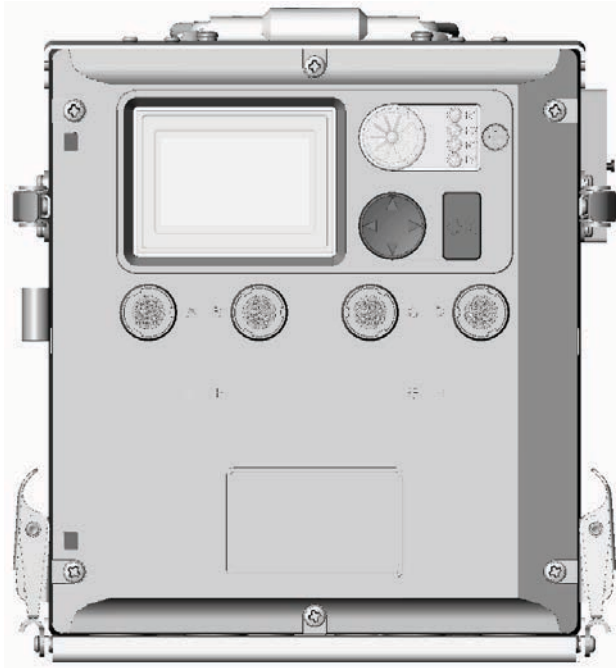
TX6377 Sentry

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1. Product Overview



TX6377 Sentry (front view)

1.1 Operating Features

- Integrated, battery powered, transportable, environmental monitoring system for use in confined spaces and refuge chambers
- Pre-calibrated plug-in Sentro eModules to continuously monitor four atmospheric gases
 - Carbon dioxide
 - Carbon monoxide (separate low and high sensors)
 - Methane
 - Oxygen
- LCD screen
- Pre-configured built-in audio/visual alarms
- Heavy duty, impact resistant housing to IP65
- EMC compliant

- Data logging on all five channels (carbon dioxide, carbon monoxide (low and high), methane and oxygen)
- Rechargeable, plug-in battery pack provides over 192 hours of operation
- Natural diffusion for internal sampling or manual gas pump manifold application for external sampling

1.2 Application

The Sentry environmental monitoring system can be stored for long periods of time in refuge chambers or confined spaces ready for immediate use if an emergency event occurs. Plug-in pre-calibrated gas sensing eModules will then continuously monitor a range of four atmospheric gases, operating a clear display of current and historic accumulated data of all the measured gas concentrations. A waterproof

Navigation Keypad gives direct access to the information:

- Instantaneous gas concentration display
- Detail information display of each gas sensor
- Minimum and maximum readings reached
- Trend analysis
- 4000 points of data logging with time and date stamp

Inbuilt audio/visual alarms provide discrete alerts of gas concentration levels exceeding factory configured thresholds. The Sentry is powered by a detachable 12 V dc rechargeable battery that will power the environmental monitoring system for more than 192 hours. A manual gas pump operated gas manifold is temporarily attached when specific measurement samples need to be taken from outside the immediate area.

Sentry is housed in a robust shockproof housing and is dust and moisture proof up to IP65 standards with integral EMC protection. Safety latches enable the front and rear halves to be quickly disassembled for maintenance and ease of transport.

1.3 Product Options

Mining Ex:

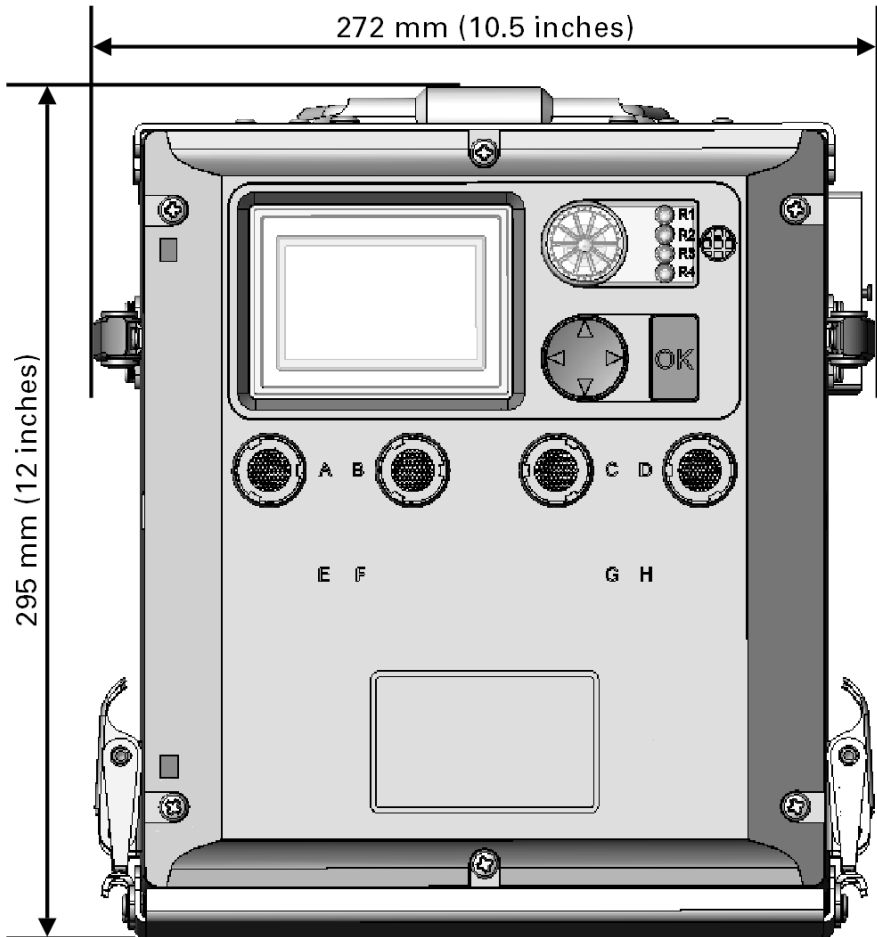
TX6377

Supply Voltage:

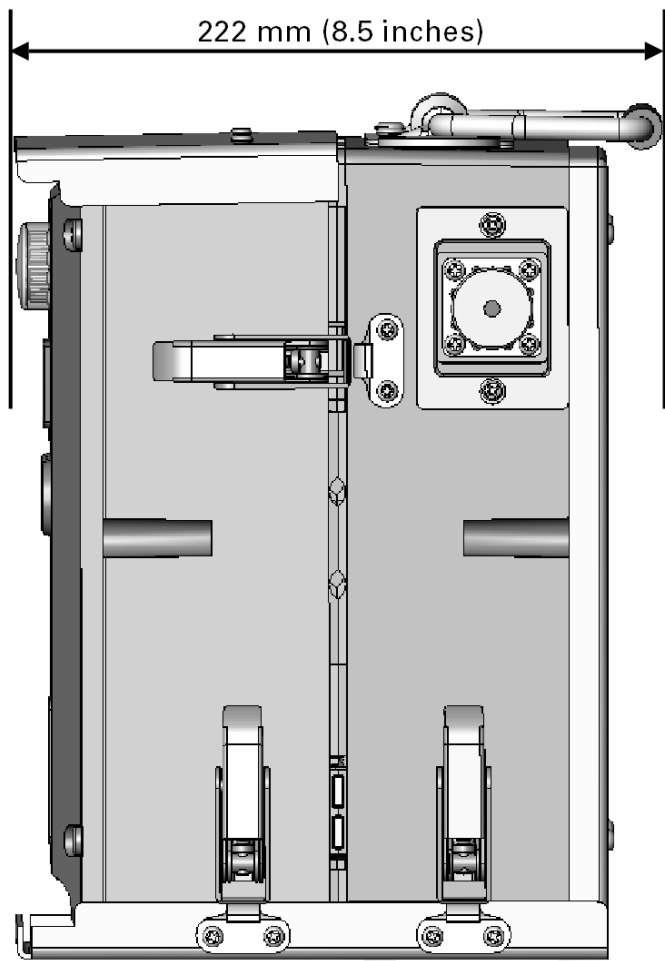
12 V dc from built in battery pack

1.4 Dimensions

1.4.1 TX6377 Sentry - Front View



1.4.2 TX6377 Sentry - Side View



1.5 Technical Information

Sensing module:	• Plug-in, pre-calibrated Sentro eModules with characterised compensation. Accommodation for up to four modules.
Protection classification:	• Housing IP65 • Gas port IP54
Operating temperature:	• -10°C to 30°C (14 to 86°F)
Storage temperature:	• -20°C to 40°C (-4 to 140°F)
Humidity:	• 0 to 95% non-condensing
Pressure:	• 700 to 1300 mbar
Housing material:	• Reinforced polymer, anti-static, suitable for use in hazardous areas. EMC compliant
Weight:	• 15 kg (33 lb)
Alarm indicators:	• High-brightness, area warning, flashing alarm and audible alarm
Audible alarm:	• Integral audible sounder 81 db at 300 mm (12 inches) • Mute function
Gas infusion:	• Natural diffusion for refuge sampling • Manual gas pump assisted gas manifold for exterior sampling

Display:	• 128 x 64 pixels, graphic LCD screen with backlight illumination • Alarm indicators for all four sensor inputs • Simultaneous readings of all sensor input levels • Individual reading of all sensor input levels with Min and Max data retention - not applicable to carbon dioxide • Graphic Trend display of individual sensor values - not applicable to carbon dioxide • Scrolling display of Logged data - not applicable to carbon dioxide
Function programming:	• Keycode security barrier - enabled by default • One factory programmed setpoint alarm level (Warning alarm), set for Over, for each sensor input • Two factory programmed setpoint alarm levels (Warning alarm), set for - Over and Under for oxygen sensor input only • Factory programmed audio visual alarm functions indicate Warning alarms • Factory programmed discrete alarm for sensor fault • 24-hour clock and calendar
Data logging:	• Automatic period logging • Default log period of 90 secs - does not log carbon dioxide readings • 4000 readings per sensor with time, date and alarm event report

1.6 Electrical Details

Sentry	
Supply voltage	12 V dc from built-in rechargeable sealed lead acid battery pack
Supply current	200 mA (maximum loading)
Typical battery life	192 hours
Battery charge time	48 hours

Sentry Charger	
Supply voltage	Universal 100 to 265 V ac 50/60 Hz
Output voltage	14.8 V dc 800 mA
Indicators	Red LED - fast charge Green LED - float charge

Caution

Only charge the Sentry battery with the Sentry battery charger.

1.7 Sentro eModules Gas Sensing Modules

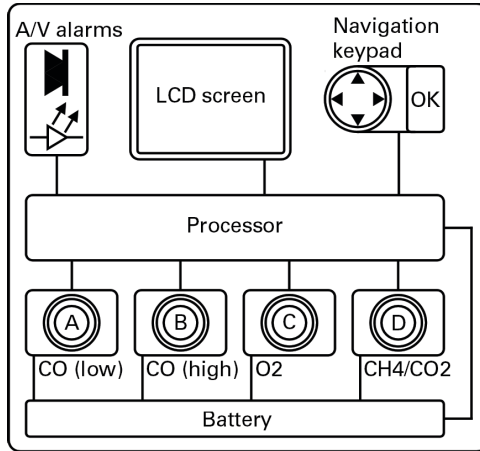
- Sentry is fitted with four plug-in pre-calibrated gas sensing modules - eModules. These are accessible when the front cover of the Sentry is removed.
- Each Sentro eModule stores all the necessary data about its type, identification, sensing range and specific calibration. This data is automatically recognised by Sentry when the eModule is loaded into the module bay
- The Sentro eModules are pre-calibrated so can be substituted at any time by a replacement eModule
- Insert coding stops ensure the correct Sentro eModule can only be fitted in the correct location
- The Sentro eModule will identify itself when plugged into its specific location and auto configuration will take place
- All Sentro eModules have a **Warning** alarm level. Default values are entered during manufacture
- A separate **Fault** signal will also be generated if a sensor electrical failure is detected or in the event of a communication failure



Sentro eModule
Integral Gas Sensor

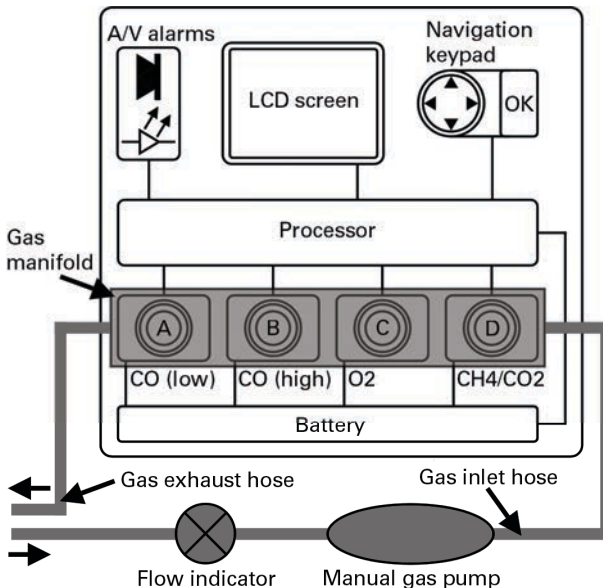
1.8 Sentry Environment Monitoring

1.8.1 Internal Environment Monitoring



1.8.2 External Environment Monitoring

Sample monitoring for external sample using a gas manifold, manual gas pump, flow indicator and gas sample hoses.



2. Certification

	1. United States of America (MSHA) IS Approval (Title 30 CFR Part 18) - Approval no. 18-A140004-0 Refuge Alternative Air Monitoring Component Approval (Title 30 CFR Section 7.507) – Approval No. LPA140001-0 Specific Conditions of Use 1. The battery is to be charged in fresh air only. 2. The Panasonic CR2032 lithium cell is not user-replaceable.
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3. Contents of Sentry Package

After receiving your Sentry you must check it is complete.

3.1 TX6377 Version

If you have ordered **TX6377** check these items are present:

1. Sentry - assembled, comprising:
 - Front half with gas manifold and a set of eModules installed
 - Rear half battery pack complete with Quick Start Guide attached
 - Base plate

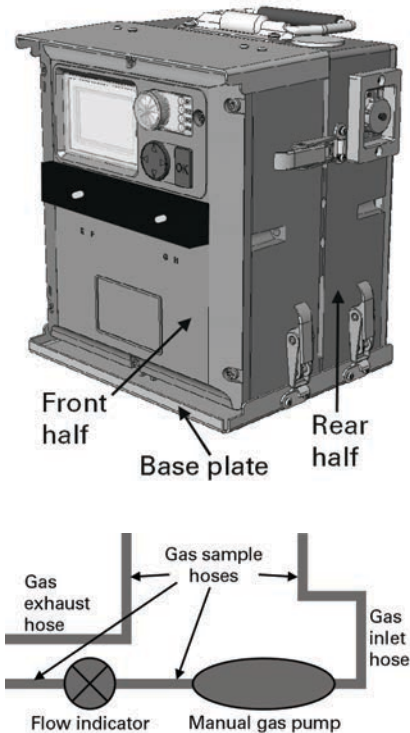
Checkpoint

The Sentry On/Off switch is protected in transit by a yellow plastic cap. Remove and discard the yellow plastic cap on receipt of your Sentry.

2. Gas sample kit, comprising:
 - Gas sample hoses
 - Flow indicator
 - Manual gas pump
3. Sentry User Manual - TX6377-UM-EN.

Checkpoint

If any items are missing or damaged contact your local Trolex service agent.



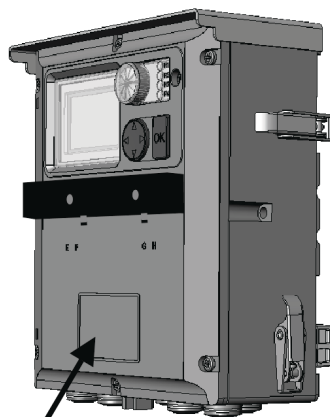
3.2 TX6377.10 Version

If you have ordered **TX6377.10** check these items are present:

1. Sentry front half with gas manifold and a set of eModules installed.

Checkpoint

The Sentry On/Off switch is protected in transit by a yellow plastic cap. Remove and discard the yellow plastic cap on receipt of your Sentry.



Front
half

2. Sentry User Manual - TX6377-UM-EN.

Checkpoint

If any items are missing or damaged contact your local Trolex service agent.



4. Installing

4.1 Safety Precautions

Hazardous Areas

DO NOT use a Sentry that has a damaged housing in the hazardous area.

Operating Life of Gas Sensors

Oxygen sensing cells must be replaced every eighteen months. Carbon monoxide, carbon dioxide and methane sensing cells must be replaced every three years.

Sensitivity

Electrochemical cells for carbon monoxide will also respond to certain cross-interfering gases, notably hydrogen and ethylene, but at lower levels.

Flammable

Be aware that some toxic gases are also 'flammable' at high percentage concentrations.

Discrimination

Infrared sensors are highly specific to the defined gas type and may NOT respond to other similar gases.

Toxicity

Be aware that most flammable gases and vapours are also toxic at low concentrations of LEL.

4.2 Tools and Test Equipment Required

No special tools or test equipment are needed.

4.3 Sentry Operation

Operation of the Sentry is described in the Sentry Quick Start Guide TX6377-QS-EN, a copy of it is attached to the Sentry rear half battery pack.

4.4 Siting Recommendations

The installation needs to be considered in its own right, with reference to safety authorities and in compliance with mandatory local safety regulations. The Sentry must be operated in accordance with the User Manual and Quick Start Guide TX6377-QS-EN to maintain safety, reliability and to preserve safety integrity where applicable.

It is important that the Sentry is located in positions determined in consultation with those who have specialised knowledge of the installation and of the principles of gas dispersion.

4.5 Sensor Management

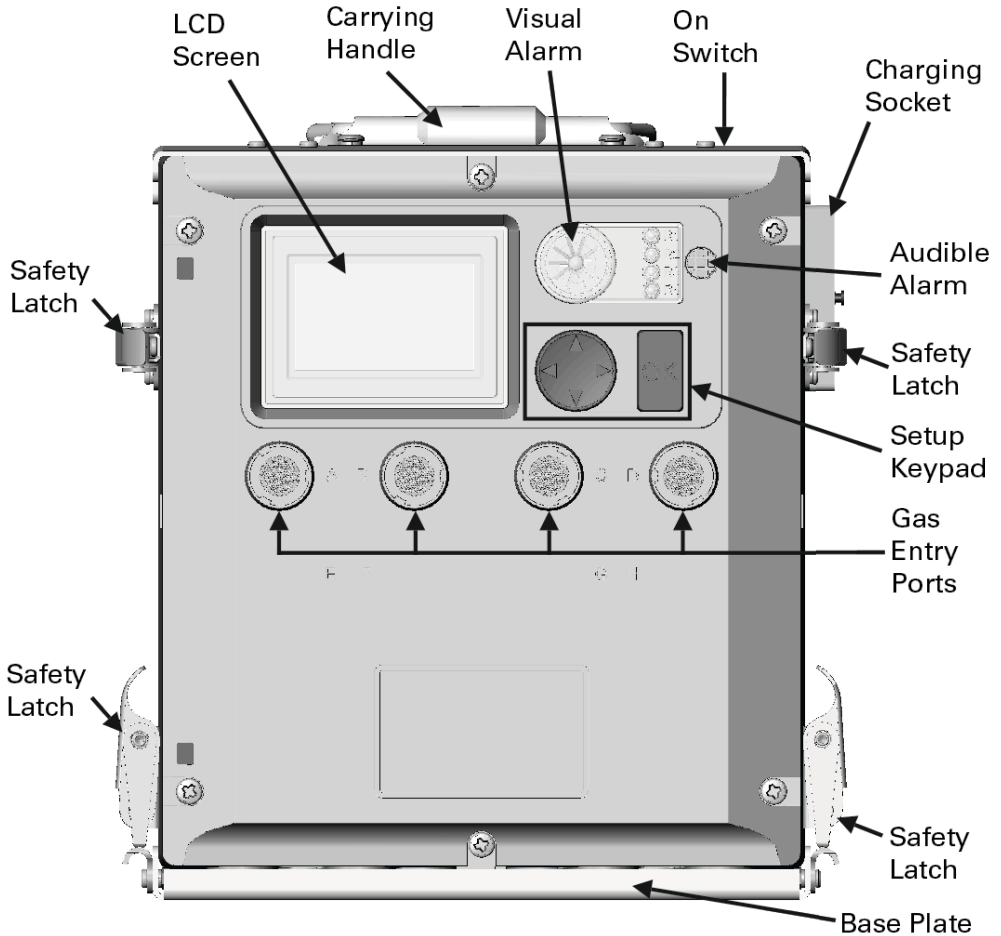
A very important part of the Sentry environmental monitoring system is the training of personnel in the operation and maintenance of the sensing eModules and the complete environmental monitoring system. Training can be provided by your local Trolex service agent.

Once a Sentry installation is complete, the Sentry rear half battery pack and eModule details should be formally recorded and a planned test and maintenance procedure instituted for pending replacement.

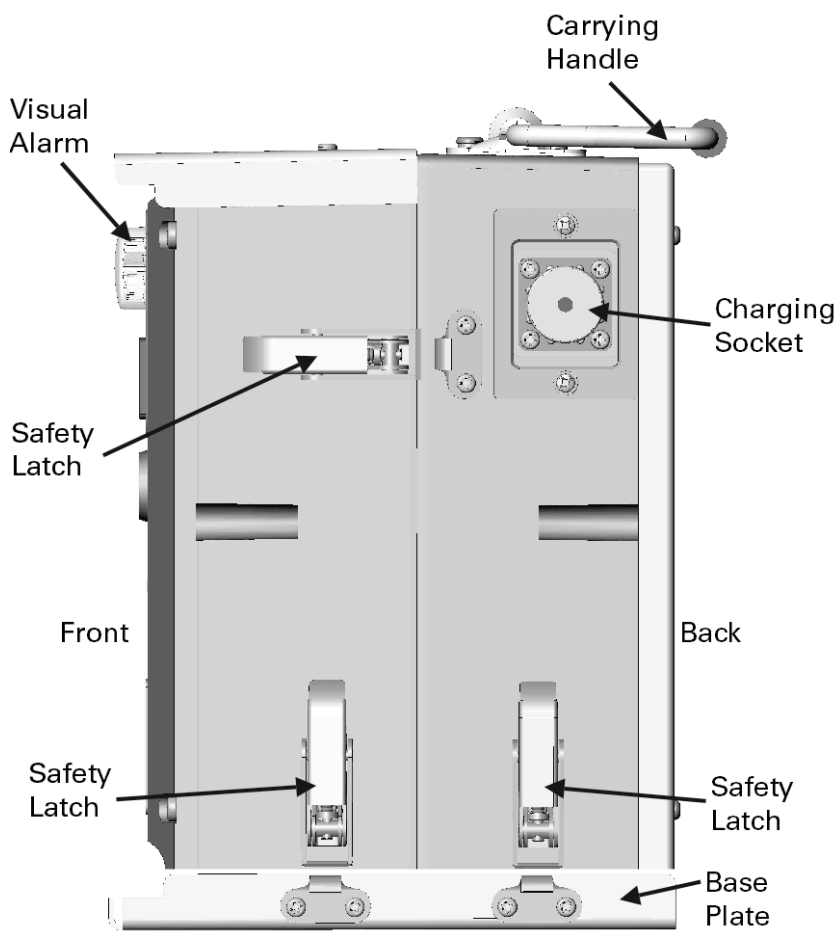
5. Setup and Calibration

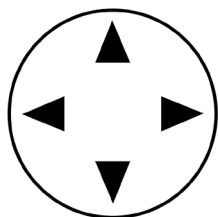
5.1 Controls and Indicators

5.1.1 Front View



5.1.2 Side View





5.1.3 Navigation

The Sentry menus are navigated using the **Setup Keypad**. The **Setup Keypad** consists of a **Navigation Keypad** and the **OK** key.

The **Navigation Keypad** is a four-way controller that allows menus to be navigated. Holding down one of the direction arrows on the **Navigation Keypad** scrolls through the menu.

The **OK** key is used to confirm menu selections.

5.2 Start-up Screen

To power-up the Sentry press the On Switch down. The On Switch is located on the top of the Sentry on the right side near the rear. When the Sentry unit is initially powered-up the Start screen will be displayed for a few seconds. The Start screen displays basic information about the Sentry system such as software version, date and time.

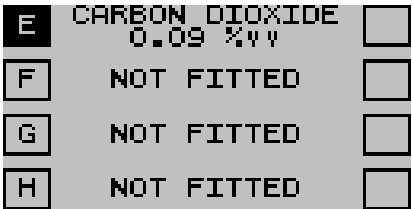
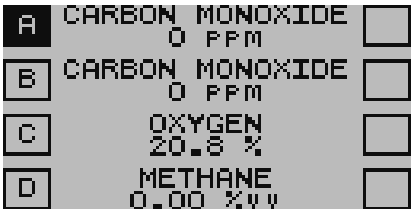
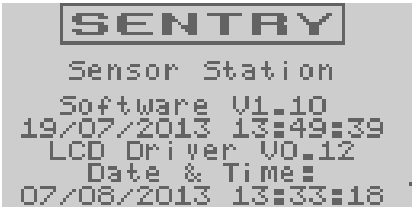
5.2.1 Base Screens

When initial power-up is complete the first of the two Base screens will appear. The Base screens display the following:

- Screen 1 - Sensor Inputs Overview 1 - showing channels A to D
 - Channel A - carbon monoxide low range
 - Channel B - carbon monoxide high range
 - Channel C - oxygen
 - Channel D - methane
- Screen 2 - Sensor Inputs Overview 2 - showing channel E
 - Channel E - carbon dioxide

Use the **Navigation Keypad** to scroll through the five channels.

When powered-up the Sentry will continuously automatically scroll between Sensor Inputs Overview 1 and 2. The screens will scroll approximately every five seconds.



Sensor Inputs Overview 1 & 2

Sensor Inputs Overview 1 & 2 display the following information about the four sensors fitted to the Sentry:

	• Channel address
	• Duty text
	• Signal status with units
	• Warning alarm
	• Over range input signal
	• Under range input signal
	• High fault
	• Low fault

5.2.2 Detailed Sensor Input View

More detailed information about the five sensor inputs can be displayed.

Use the **Navigation Keypad** and scroll down through the two **Base** screens of **Sensor Input Overview**.

Identify the sensor input you wish to view in detail and select using the **OK** key.

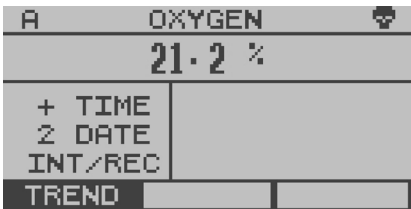
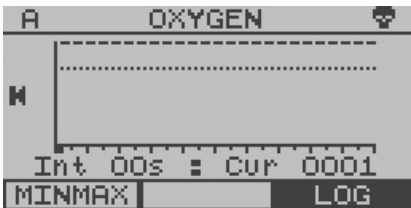
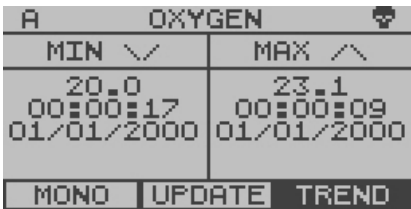
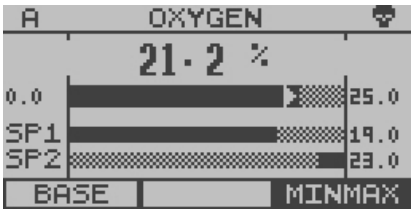
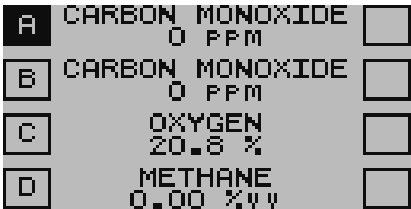
The detailed view of each sensor input is displayed on four screens in the following order:

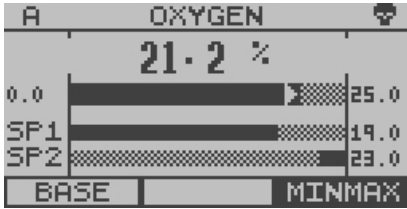
- Mono
- Minmax
- Trend
- Log

The **Mono View** appears first. Use the **OK** key to step down through the detail views, back up through the detail views and back again to the **Base** screens displaying the **Sensor Inputs Overview 1 & 2**.

Checkpoint

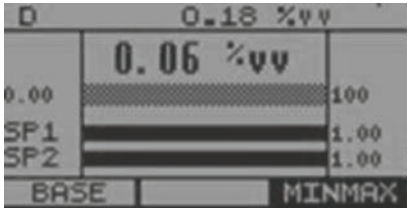
The direction of a step can be changed at any time by using the **Navigation Keypad** to highlight the next view required in the bottom bar.





5.2.3 Mono View

This displays more detailed information about individual sensor inputs.



Checkpoint

The **Mono View** for sensor input D displays two values. The two values are for two different gases. The upper value (0.18 % v/v in this example) is the carbon dioxide level. The lower value (0.06 % v/v in this example) is the methane level. The carbon dioxide level will only be displayed on this screen.



Sensor Input Information

This is a bar graph of the input signal with lower and upper scale values on the left and right. The arrow indicates increasing/stable/decreasing signal tendency.



Warning alarm marker with a numerical value on the right side.



Alarm Messages

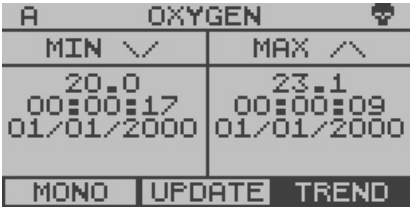
- Warning alarm
- The input signal is under range
- The input signal is over range
- The input signal is low fault
- The input signal is high fault



5.2.4 Minmax View

The **Minmax View** is the maximum value and minimum value that the signal has reached since last updated with time and date stamp.

To update the values displayed, scroll left or right using the **Navigation Keypad** to highlight **Update** and select the **OK** key.

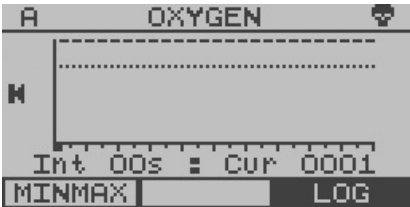


5.2.5 Trend View

The display field shows 100 logged readings and will jump forward in lots of ten.

Total maximum logged readings 1 to 4000.

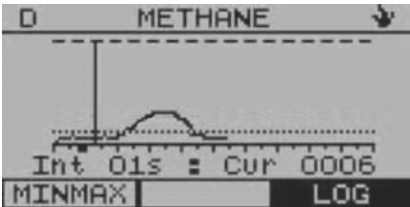
- Warning alarm setpoint
- Trend cursor



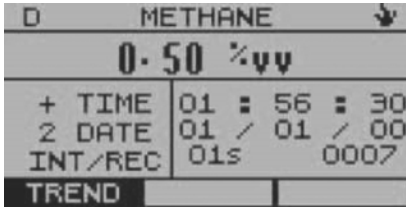
To Review the Trend

Use the **Navigation Keypad** and scroll up or down to review the **Trend**.

Select the **OK** key to view the **Actual Log** values at the current trend cursor position.



Select the **OK** key to **Return**.



5.2.6 Log View

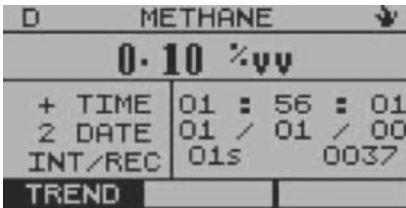
Details of the data present at the **Trend Cursor** position selected. This data is recorded in the **Log**.

To Review the Trend

Use the **Navigation Keypad** and scroll up or down to review the **Log**.

Select the **OK** key to view the general **Trend** around the current **Log** entry.

Select the **OK** key to **Return**.



5.3 Sentry Security Barrier

Checkpoint

By default the Sentry **Security Barrier** is enabled. This prevents users from gaining access to factory preset unit configuration parameters.



6. Audio/Visual Alarm References

Alarm signals and **Fault** signals are pre-assigned to operate the audio visual alarms.



Warning Alarm

Faster, double repeating pulse



Checkpoint

To view detailed information on an **Alarm Event** and mute the **Audible Alarm**, enter the **Mono View**.



7. First Level Maintenance, Repair and Spares

7.1 Sentry Planned Preventative Maintenance

7.1.1 Introduction

To keep your Sentry in the best possible condition and ready for use in an emergency event, Trolex strongly recommends that you carry out regular planned preventative maintenance and keep records of the maintenance carried out.

The planned preventative maintenance for Sentry consists of a number of tasks carried out at regular intervals on a cumulative basis, ie at 18 months do the 18 month jobs **AND** the six month jobs. These tasks are listed in the maintenance schedule below:

Equipment Name	Task Type	Task Number	Interval
Sentry Parts and Accessories	Check	7.1.3	6 months
Sentry	Check	7.1.4	6 months
Sentro eModules	Calibrate	7.1.5	6 months
Sentry	Bump Test	7.1.6	6 months
Sentry	Stow	7.1.7	6 months
Sentry Rear Half Battery Pack	Charge	7.1.12	6 months
Sentry oxygen eModule	Replace	7.1.8	18 months
Sentry carbon monoxide eModules	Replace	7.1.9	3 years
Sentry carbon dioxide/methane eModule	Replace	7.1.10	3 years
Sentry Rear Half Battery Pack	Replace	7.1.11	3 years

Checkpoint

The optimum ambient storage temperature range for the Sentry rear half battery pack is 0 to 30°C (32 to 86°F). If Sentry rear half battery packs are stored at higher temperatures they will need to be recharged and replaced at more frequent intervals than those specified above. Please contact the Trolex technical department if you need further advice.

7.1.2 Tools and Materials

Six Month Tasks

To carry out the six month planned preventative maintenance tasks you will need the following items:

EITHER

1. A Sentry Minor Service Kit *
2. Flat blade and a cross head screwdrivers.
3. Optional - a Sentry Base Maintenance Kit **

* The Sentry Minor Service Kit can be obtained from your local Trolex service agent. For details of this equipment refer to Appendix C.

** The Sentry Base Maintenance Kit can be obtained from your local Trolex service agent. For details of this equipment refer to Appendix C.

OR

1. A set of seven test gases, regulators to suit, PTFE gas hose 4 mm internal diameter and a Trolex gas hood. For details of this equipment refer to Appendix C.

Eighteen Month Task

To carry out the eighteen month planned preventative maintenance task you will need the following items:

1. A Sentry Interim Service Kit *

* The Sentry Interim Service Kit can be obtained from your local Trolex service agent. For details of this equipment refer to Appendix C.

Three Year Task

To carry out the three year planned preventative maintenance tasks you will need the following items:

1. A Sentry Major Service Kit *

* The Sentry Major Service Kit can be obtained from your local Trolex service agent. For details of this equipment refer to Appendix C.

Checkpoint

Do not use a battery underground if it is beyond the end date of its usable life.

Operational Spares

Your Sentry comes complete with spare Carbon Dioxide/Methane and Oxygen eModules. These come complete with the tools and instructions required to fit them.

Checkpoint

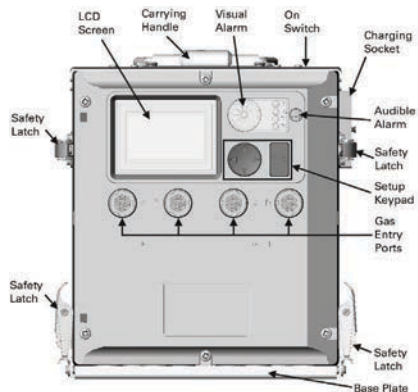
Sentro eModules can be replaced underground even when the Sentry is powered up and in use.

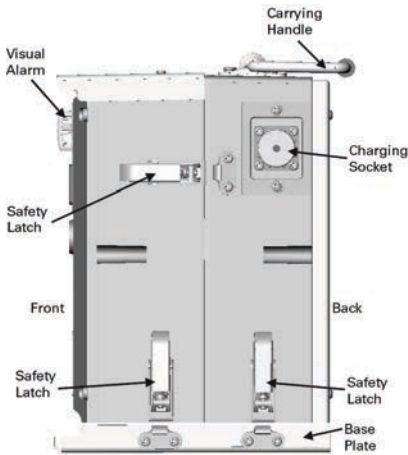
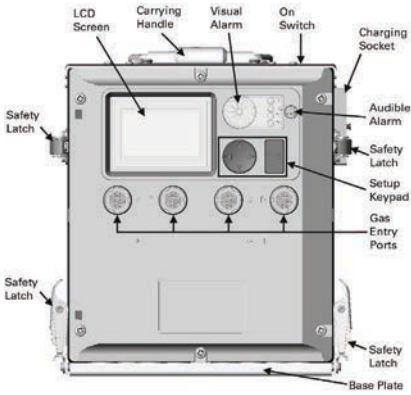
7.1.3 Sentry Parts and Accessories - Check

Checkpoint

This maintenance task can be carried out underground.

1. Open the Sentry storage location and check that the Sentry is present and correctly stowed.
2. Check all four parts of the Sentry are present:
 - Sentry front half complete with gas manifold
 - Sentry rear half battery pack complete with Sentry Quick Start Guide TX6377-QS-EN attached
 - Sentry base plate
 - Sentry gas sample kit containing:
 - manual gas pump
 - gas sample hoses
 - flow indicator
3. Replace any missing items as necessary.
4. Remove the Sentry from the storage location and place it in a location where it can be safely maintained.
5. After the completion of all maintenance, update the maintenance records.





7.1.4 Sentry - Check

Checkpoint

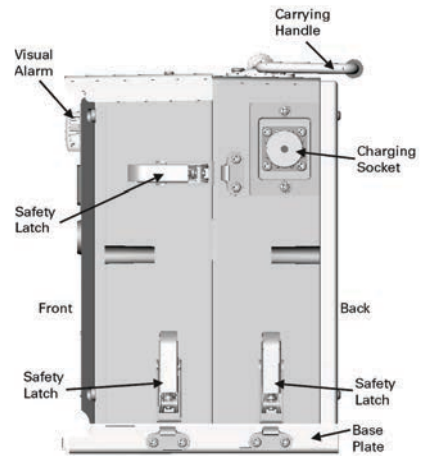
This maintenance task can be carried out underground.

Check all items of the Sentry for signs of wear and damage as follows:

Sentry

1. Check the exterior of the Sentry for cracks, penetration, water ingress, battery electrolyte leak, signs of being dropped or other damage.
2. Check that the metal top plate is free from damage, deformation and is securely attached.
3. Check that the carrying handle is securely attached.
4. Check the base plate is free from damage and distortion.
5. On the rear half, check that the Quick Start Guide is attached, undamaged and in legible condition.
6. Check the charging socket is free from damage, securely attached and the cover is in place.
7. Check that the six safety latches are present, free from damage, deformation and are securely attached.
8. Check the LCD screen is clear and free from damage.
9. Check that the Navigation Keypad and OK key are free from damage.
10. Check the audio visual alarm indicators are free from damage.
11. Check that the gas manifold is present, is secured in place by two thumb screws, is undamaged and a gas manifold port plug is fitted to both gas manifold ports.

11. Check that the gas manifold is present, is secured in place by two thumb screws, is undamaged, is fitted with an Inlet label, is fitted with and Exhaust label and a gas manifold port plug is fitted to both gas manifold ports.
12. Check that the Maintenance Record Label is fitted and is legible. Replace as necessary.
13. If any part of the Sentry shows any signs of damage, deformation or missing parts, immediately remove it from service and replace it with a working Sentry.
14. Return the defective Sentry to your local Trolex service agent for repair and testing.



Sentry Battery Pack

1. Disassemble the Sentry as follows
 - release the four safety latches that secure the base plate to the front and rear halves. Lift the front and rear halves off the base plate. Release the two safety latches that secure the front and rear halves together and separate the front and rear halves.
2. On the front half check the power connectors are free from damage and securely attached.
3. Replace the Sentry rear half battery pack and exchange it for a fully charged rear half battery pack in good working order.
4. On the removed rear half battery pack, check the battery pack is within its usable life. The end date of the battery pack usable life is on a label applied to the battery pack.

Checkpoint

Do not use a battery underground if it is beyond the end date of its usable life.

5. Remove the discharged rear half battery pack from the mine and recharge it in a safe area in accordance with the instructions in task 7.1.12.
6. If the removed rear half battery pack shows any signs of damage, deformation or missing parts immediately remove from service and return to your local Trolex service agent for repair and testing.

Gas Sample Kit

1. Check the gas sample hoses are free from damage, kinks and obstructions that could affect their function.
2. Blow into the flow indicator and ensure it spins.
3. Operate the manual gas pump and ensure air is blown out of it.
4. Replace any parts that are damaged, deformed or not functioning correctly.

Assembly

1. Assemble the Sentry as follows:
2. Fit the front and rear halves together, take care to avoid damaging the power connectors and secure with the two safety latches.
3. Lift the front and rear halves on the base plate and secure with four safety latches.
4. After the completion of all maintenance, update the maintenance records.

7.1.5 Sentro eModules - Calibrate

Checkpoint

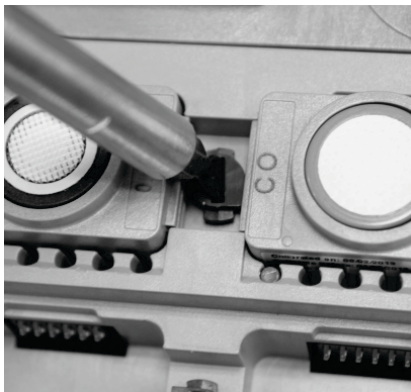
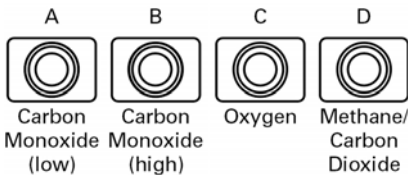
This maintenance task can be carried out underground.

There are two ways to calibrate the Sentro eModules. The simplest way is to remove the set of four eModules, replace with a new set of calibrated eModules and return the removed eModules to your local Trolex service agent. Alternatively carry out a calibration using test gases with the eModules in the Sentry unit. Both methods are described in the following sections, only one needs to be carried out. The choice of which method to calibrate the eModules you use is yours.



7.1.5.1 Sentro eModules - Calibrate by replacement

The Sentry sensing eModules are easily and conveniently replaced in seconds. They simply plug-in to the Sentry unit with no special tools required. A minimum of hand tools is all that is required for replacement. They are Trolex pre-calibrated to specific measuring parameters and need no precision calibration facilities. Once removed the set of eModules can either be returned to Trolex for calibration or calibrated for reuse using the Base Maintenance Kit. Using the Minor Service Kit, replace the complete set of four Sentry sensing eModules as follows:



1. Refer to section 4.1 - Safety Precautions for details of precautions to be taken before starting maintenance work on the Sentry.
2. Identify the eModules to be replaced.
3. On the front of the Sentry use a cross head screwdriver and remove the six screws securing the front panel of the Sentry. There are three screws at the top and three at the bottom.
4. Swing the front panel out of the way.
5. Using a suitable size flat blade screwdriver turn the module retainer screw anti-clockwise to release the eModule.
6. Remove the eModule from the module bay.
7. Insert the replacement eModule into the module bay ensuring that the connector is fully engaged. Ensure the seal on the top of the eModule is intact and firmly attached.

Checkpoint

The eModules are location specific and cannot be fitted in a different location. All Sentry's have insert coding stops fitted to ensure that eModules can only be fitted in the correct location.

8. Using a suitable size flat blade screwdriver turn the module retainer screw clockwise to secure the eModule.
9. Repeat for all eModules to be replaced.
10. After fitting the four eModules close the Sentry front panel and secure using the six captive screws and a cross head screwdriver.

Checkpoint

Tighten the six screws evenly to avoid the possibility of distorting the Sentry front panel. **DO NOT OVER-TIGHTEN** the six screws.

EITHER

11. Put all removed eModules into the postage paid and pre-addressed Jiffy bag and return them to your local Trolex service agent for calibration.

OR

11. Calibrate the eModules using the Base Maintenance Kit.
12. The calibration certificates supplied with the new eModules must be retained with the Sentry maintenance records until the next six monthly maintenance task.

13. After the completion of all maintenance, update the maintenance records.

Checkpoint

If the Sentry eModules are replaced then a Bump Test **MUST** be carried out in accordance with section 7.1.6.

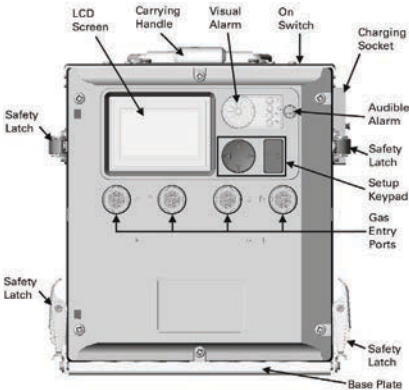
7.1.5.2 Sentry eModules - Calibrate using test gases

1. Unscrew the two thumb screws securing the gas manifold, remove the gas manifold and switch On.
2. Wait two minutes for the Sentry to power up and the background gas concentration readings to stabilise.
3. Calibrate the complete set of four Sentry eModules as follows:

Checkpoint

Ensure the area where the Sentry is being calibrated is well ventilated. Observe appropriate Health and Safety legislation and applicable local procedures when handling test gases.

4. Fit the gas hood to the corresponding gas port of the module being calibrated. Connect the gas application tube to the clean air test gas cylinder and gas hood.



Checkpoint

The carbon dioxide sensor (displayed on channel E) must have Nitrogen of 100% v/v applied, NOT clean air, to **Zero** the sensor.

Checkpoint

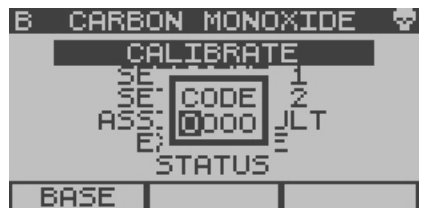
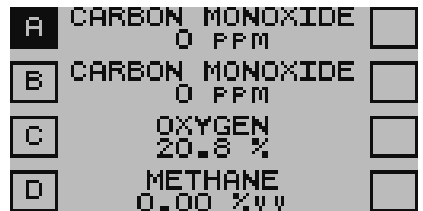
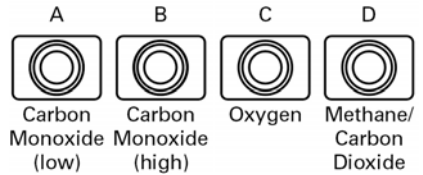
Channel A - carbon monoxide low, Channel B - carbon monoxide high, Channel C - Oxygen and Channel D - methane low, methane high and Carbon monoxide

- From the **Base** screens, use the **Navigation Keypad**, scroll to the required channel A, B, C, D or E.
- Press and hold down the **Left** arrow on the **Navigation Keypad**. After a few seconds the **eModule Setup Menu** will appear.

Checkpoint

On channel inputs D and E a choice of calibrate options will be shown **Calibrate CH4 Lo**, **Calibrate CH4 Hi** and **Calibrate CO2**. Navigate to the sensor input you wish to calibrate and select **OK**.

- From the **eModule Setup Menu** select **Calibrate**. The Sentry will ask for a **Security Code**, enter the **Security Code** and select **OK**.



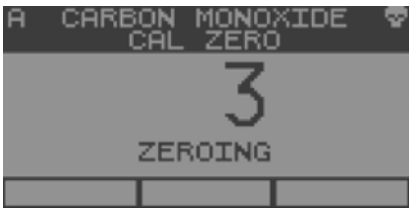


Zero

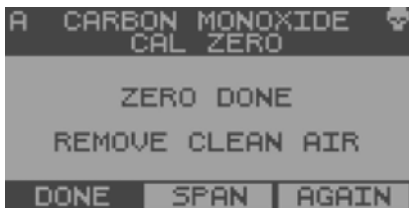
1. The display will show an arbitrary reading.
2. Open the valve and apply oxygen from the test gas cylinder at a rate of 0.5 litre/min (30 cu in/min) to clear any gas from the sensor.

Checkpoint

The carbon dioxide sensor (displayed on channel E) must have Nitrogen of 100% v/v applied, NOT clean air, to **Zero** the sensor.



3. Wait for the reading to settle at a stable value, not necessarily 0.
4. When stable select **OK** to **Zero** the reading.
5. Close the valve and stop the supply of oxygen, or nitrogen for the carbon dioxide sensor.
6. Disconnect the application tube from the gas hood.
7. Use the **Navigation Keypad**, scroll to **Span** and select **OK**.



Check

1. The display shows the **Span** value of gas that the Sentry expects to be used during calibration.
2. Check the **Span** value of gas displayed against your test cylinder. The correct value of **Span** gases are as follows:

- Sensor A - carbon monoxide - 50 ppm
- Sensor B - carbon monoxide - 500 ppm
- Sensor C - oxygen - 23% v/v
- Sensor D - methane - 2.5% v/v
- Sensor D - methane - 100% v/v
- Sensor D - carbon dioxide - 4% v/v

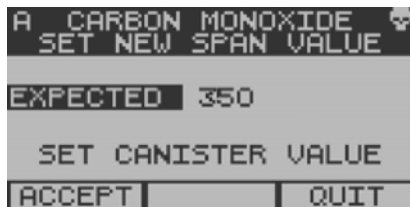
3. If the two values match use the **Navigation Keypad**, scroll to **Accept** and select **OK**. Proceed to the **Calibrate Span** procedure.

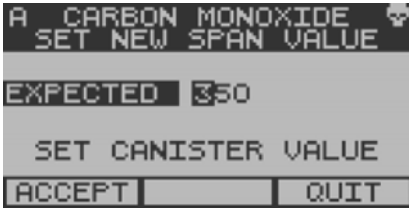


4. If they do not match then proceed as follows, use the **Navigation Keypad**, scroll to **Change** and select **OK**.



5. With **Expected** highlighted select **OK**.





6. With the first digit highlighted, use the **Navigation Keypad**, scroll up or down on the first digit to the required **Span** value on your test cylinder.
7. Scroll right to the second digit. Repeat the above for the second and third digit in **Span** and select **OK**.
8. Scroll to **Accept** and select **OK**.
9. Continue with **Calibrate Span** as described in the following section.

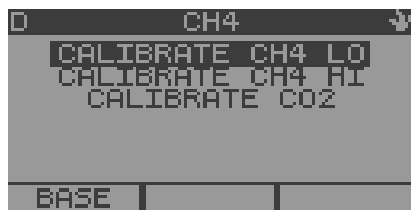
Calibrate Span - Using a Test Gas of an Expected Value

1. Connect the gas application tube from the appropriate test gas cylinder to the gas hood fitted to the corresponding gas port of the module being calibrated.
2. Open the valve and apply test gas at a rate of 0.5 litre/min (30 cu in/min) to clear any oxygen from the sensor.
3. Wait for the reading to settle at a stable value - this is not necessarily the **Span** gas value and select **OK** when stable.

4. Select **OK** again if the display value continues to shift.
5. Use the **Navigation Keypad**, scroll to **Done** or **Quit** in the toolbar and select **OK**.
6. Shut the valve and stop the supply of test gas to the sensor. Disconnect the application tube from the gas hood.
7. Scroll to the **Base Screens** and select **OK**.
8. Repeat the calibration process for all four Sentro eModules fitted to the Sentry.

Checkpoint

The Sentro eModule fitted to the Sentry in location D must be tested three times. Once each for **methane low** - 0 to 5.99%, **methane high** - 6 to 100% and **carbon dioxide**.



9. If any Sentro eModule fails to show the correct gas concentration reading during calibration it must be removed from the Sentry and a new eModule fitted. You must carry out a Bump Test on the new eModule in accordance with 7.1.6 to ensure it functions correctly.

10. Switch off the Sentry, remove the gas hood, refit the gas manifold and secure with two thumbscrews. Tighten thumb screws by hand but - **DO NOT OVERTIGHTEN**.
11. After the completion of all maintenance, update the maintenance records.

7.1.6 Sentry - Bump Test

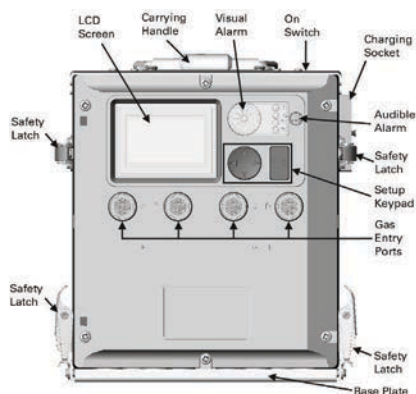
Checkpoint

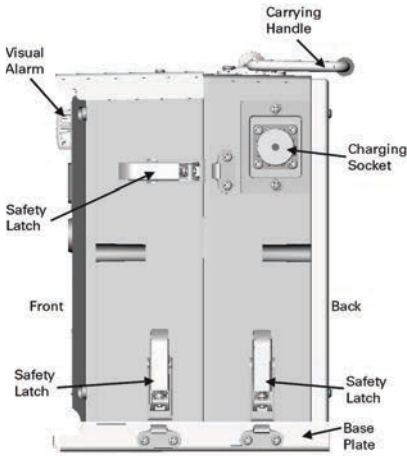
This maintenance task can be carried out underground.

Checkpoint

If the full set of four eModules has been replaced, then a Bump Test **MUST** be carried out. If the eModules have been calibrated using test gases then the Bump Test is **NOT** required.

1. Unscrew the two thumb screws securing the gas manifold, remove the gas manifold and switch On.
2. Wait two minutes for the Sentry to power up and the background gas concentration readings to stabilise.
3. Note the background gas concentration readings.
4. Spray a 10 second burst of test gas from the aerosol on to one of the four gas ports.
5. On the LCD screen check that the gas concentration reading rises and then falls back to the background level. This may take up to 25 seconds from the end of the burst of test gas.
6. Repeat the above two steps for the other three gas ports.
7. Dispose of the aerosol test gas cylinder in accordance with local procedures. Do not reuse the aerosol.





8. Switch Off the Sentry, refit the gas manifold and secure with two thumbscrews. Tighten thumb screws by hand but - **DO NOT OVERTIGHTEN**.
9. Ensure the gas manifold port plugs are fitted to both gas manifold ports.

Checkpoint

If the Sentry fails the above test, replace the defective module with a working module of the same type in accordance with the instructions in section **7.1.5.1** and repeat the bump test on the replaced module.

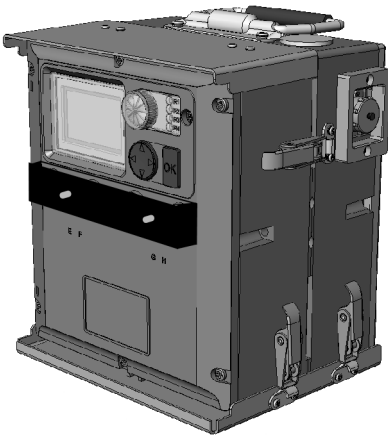
10. After the completion of all maintenance, update the maintenance records.

7.1.7 Sentry - Stow

Checkpoint

This maintenance task can be carried out underground.

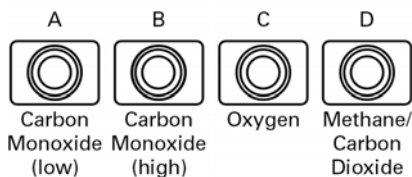
1. Open the Sentry storage location and stow the Sentry in its correct location.
2. After the completion of all maintenance, update the maintenance records.



7.1.8 Sentry Oxygen eModule - Replace

Checkpoint

This maintenance task can be carried out underground.



1. Using the Sentry Interim Service Kit, replace the Sentry oxygen eModule in accordance with the instructions in section **7.1.5.1**.
2. Ensure a **Bump Test** is carried out on the eModule after it is fitted, in accordance with the instructions in section **7.1.6**.
3. Dispose of the replaced eModule in accordance with the instructions in section 7.6.
4. After the completion of all maintenance, update the maintenance records.

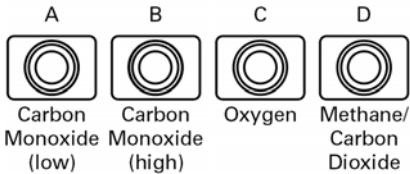
7.1.9 Sentry Carbon Monoxide eModules - Replace

Checkpoint

This maintenance task can be carried out underground.

1. Using the Sentry Interim Service Kit, replace both of the Sentry carbon monoxide eModules in accordance with the instructions in section **7.1.5.1**.

2. Ensure a **Bump Test** is carried out on the eModules after they are fitted, in accordance with the instructions in section **7.1.6**.
3. Dispose of the replaced eModule in accordance with the instructions in section 7.6.
4. After the completion of all maintenance, update the maintenance records.



7.1.10 Sentry Carbon Dioxide/ Methane eModule - Replace

Checkpoint

This maintenance task can be carried out underground.

1. Using the Sentry Interim Service Kit, replace the Sentry carbon dioxide/ methane eModule in accordance with the instructions in section **7.1.5.1**.
2. Ensure a **Bump Test** is carried out on the eModule after it is fitted, in accordance with the instructions in section **7.1.6**.
3. Dispose of the replaced eModule in accordance with the instructions in section 7.6.
4. After the completion of all maintenance, update the maintenance records.

7.1.11 Sentry Rear Half Battery Pack - Replace

Checkpoint

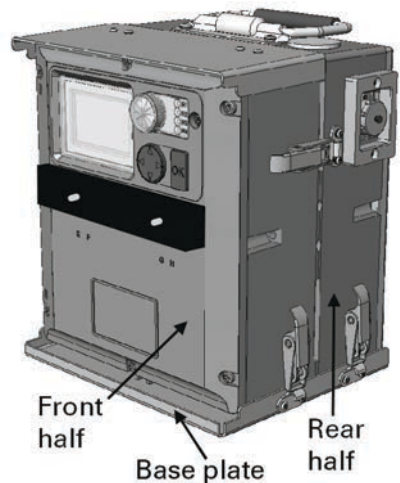
This maintenance task can be carried out underground.

1. Open the Sentry storage location and remove the Sentry.
2. Disassemble the Sentry as follows
- release the four safety latches that secure the base plate to the front and rear halves. Lift the front and rear halves off the base plate. Release the two safety latches that secure the front and rear halves together and separate the front and rear halves.
3. Check the battery pack is within the end date of its usable life. The end date of the battery pack usable life is on a label applied to the battery pack.
4. If any Sentry rear half battery pack is beyond the end date of its usable life, or will be beyond the end date of its usable life within the next six months, immediately remove it from service and dispose of in accordance with the instructions in section 7.6.
5. Replace the battery with a new battery from the Sentry Major Service Kit.

Checkpoint

Ensure the replacement Sentry rear half battery pack has a Sentry Quick Start Guide TX6377-QS-EN attached to the rear in a clear wallet.

6. After the completion of all maintenance, update the maintenance records.





7.1.12 Sentry Rear Half Battery Pack - Charge

Checkpoint

This maintenance task **CANNOT** be carried out underground.

To charge the Sentry rear half battery pack:

1. Check the battery pack is within its usable life. The end date of the battery pack usable life is on a label applied to the battery pack.

Checkpoint

Do not use a battery underground if it is beyond the end date of its usable life.

2. Plug your Sentry battery charger into the mains power supply.

Checkpoint

Only use the Sentry battery charger to charge a Sentry rear half battery pack.

DO NOT use any other battery charger to charge a Sentry rear half battery pack. **DO NOT** use the Sentry battery charger to charge any other battery.

3. Unscrew and remove the cap covering the battery charging socket on the Sentry rear half battery pack.
4. Fit the Sentry battery charger charging plug to the battery charging socket and secure with the threaded collar.
5. Switch on the mains supply to the battery charger. Check the red LED (fast charge) on the battery charger illuminates. Charge the Sentry rear half battery pack for 48 hours.

Checkpoint

The battery charger will automatically reduce the charge level to the Sentry rear half battery pack to prevent overcharge.

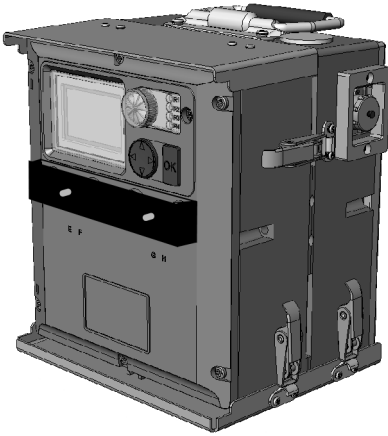
6. After 48 hours check the green LED (float charge) is illuminated on the Sentry battery charger. Switch off the battery charger and remove the charging plug from the Sentry rear half battery pack. Refit the cap to the battery charging socket.
7. After charging, fit a 0-5 A ammeter (FLUKE model 179 or similar) across the rear half battery pack power connectors. Switch on the battery pack and check the output current is 1.2 A for 5 seconds. If the output current is less than 1.2 A for 5 seconds remove the battery pack from service and replace with a working battery pack.
8. Store the Sentry rear half battery pack in a suitable location ideally with an ambient temperature below 30°C (86°F).

Checkpoint

The optimum ambient storage temperature range for the Sentry rear half battery pack is 0 to 30°C (32 to 86°F). If the Sentry rear half battery pack is stored at higher temperatures it will need to be recharged and replaced at more frequent intervals than specified. Please contact the Trolex technical department if you need further advice.

9. After the completion of all maintenance, update the maintenance records.





7.2 Sentry - Repair

Should your Sentry become damaged and require repair, immediately remove it from service and contact your local Trolex service agent.

7.3 Sentry - Post Emergency Event Overhaul

If your Sentry is used in an emergency event the following task **MUST** be completed:

1. Return your Sentry to your local Trolex service agent. The Sentry will be overhauled as follows:
 - Manual gas pump, gas sample hoses, flow indicator and gas manifold will be replaced
 - All four Sentro eModules will be replaced
 - A full inspection of the interior, exterior and all components
 - A new Sentry Quick Start Guide
 - A full system test
 - A battery discharge test
 - A battery charge
 - Calibration

7.4 Maintenance Records

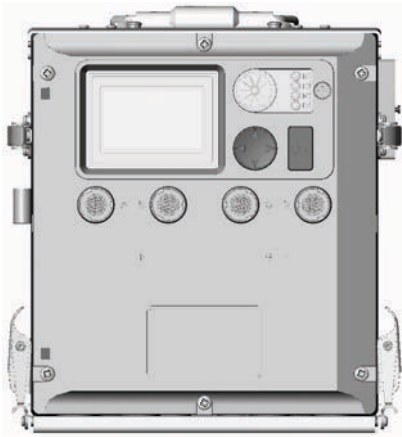
Implement a planned preventative maintenance process and keep good maintenance records.

Consult your local Trolex service agent or the Trolex Product Support Department: service@trolex.com for help in implementing a planned preventative maintenance process. The 'Maintenance Log' gives an example of a typical maintenance record system.

7.5 Maintenance Log

Order Reference: TX6377 Sentry	
Serial Number:	Date Purchased:
Gas Types: CO - CO ₂ - CH ₄ - O ₂	Location:

Date	Maint Task No.	Fault	Recalibrate	Change Modules	Return to Trolex	Comments



7.6 Disposal

Part of the ethos of Trolex is sustainable design. Sentry contains materials that can be recovered, recycled and reused. At the end of its useful life ensure that the Sentry is recycled in accordance with local laws and bylaws for the geographic area where it is located. The end of its useful life is to be determined by the owner/operator of the equipment and not Trolex. Ensure that the Sentry is recycled by a licenced waste handling organisation with the appropriate licences for handling electronic waste in the geographic area where the Sentry is located.

Sentro eModules contain mildly corrosive substances. Sentry rear half battery packs contain highly corrosive substances.

Checkpoint

Consult your local Trolex service agent or the Trolex Product Support Department if you require assistance: service@trolex.com

7.7 Recommended Spares

The recommended spare parts for the TX6377 - Sentry are listed in the table below:

Description	Quantity	Part No.
Sentry front half with a set of eModules, a gas manifold and User Manual	1	TX6377.10
Sentry rear half battery pack with Quick Start Guide	1	TX6377.50
Gas sample kit - manual gas pump, gas sample hoses, flow indicator and storage bag	1	TX6377.52
Sentry gas manifold	1	TX6377.54
Sentry Base Maintenance Kit	1	KS 6377.01
Sentry Minor Service Kit	1	KS 6377.02
Sentry Interim Service Kit	1	KS 6377.03
Sentry Major Service Kit	1	KS 6377.04
Trolex Sentry eModule - methane and carbon dioxide	1	TX6350.01.247
Trolex Sentry eModule - carbon monoxide low	1	TX6350.01.250.50S
Trolex Sentry eModule - carbon monoxide high	1	TX6350.01.250.1000S
Trolex Sentry eModule - oxygen	1	TX6350.01.257S
Screwdrivers - cross head and flat blade *	1	SC185.0153

* screwdrivers are required to replace eModules

8. Appendix A

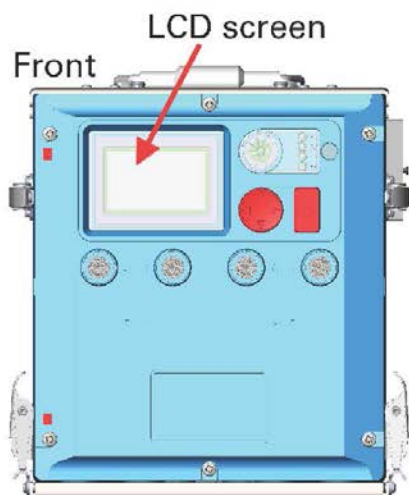
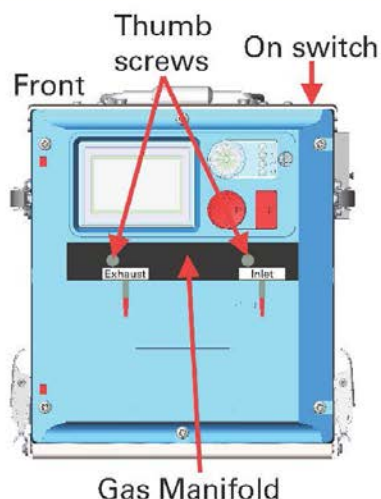
8.1 The Sentry Quick Start Guide

The following pages contain the Sentry Quick Start Guide TX6377-QS-EN.

TX6377 Sentry Quick Start Guide

TO OPERATE SENTRY

1. Remove Gas Manifold from Sentry by unscrewing two Thumb Screws on front of Gas Manifold.
2. Press On Switch down to power-up Sentry. The LCD Screen will illuminate for **TEN** seconds. Sentry is now measuring internal gas levels.
3. After power-up, wait **TWO** minutes to let internal gas level readings stabilise. Check internal gas level readings on LCD Screen.

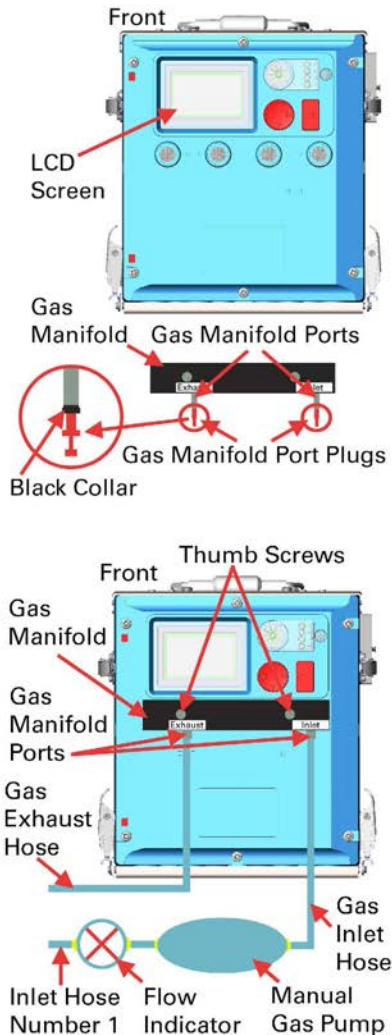


Default Alarm Setpoints

O ₂	19% to 22.5%	Range
	<19% OR >22.5%	Warning
CO ₂	<1%	Range
	>1%	Warning
CH ₄	<1%	Range
	>1%	Warning
CO	<25 ppm	Range
	>25 ppm	Warning

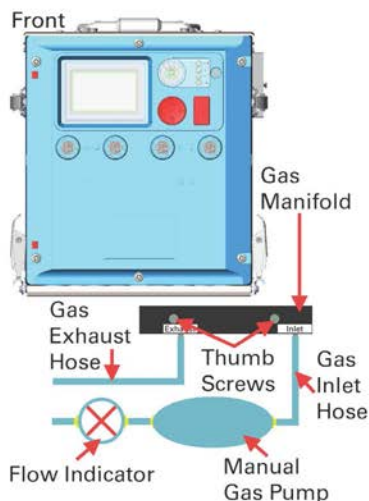
TX6377 Sentry Quick Start Guide

4. When required, test external gas levels. Refit Gas Manifold to Sentry, ensure Gas Manifold Ports are pointing downwards and secure with two Thumb Screws. Evenly tighten two Thumb Screws by hand but - **DO NOT OVERTIGHTEN**.
5. Press up Black Collar and remove red Gas Manifold Port Plug fitted to each of two Gas Manifold Ports. Fit end of Gas Exhaust Hose (plain hose) to left Gas Manifold Port (Exhaust). Fit end of Gas Inlet Hose nearest Manual Gas Pump to right Gas Manifold Port (Inlet). Push other ends of gas hoses through gas sample aperture in refuge.
6. To operate Manual Gas Pump, squeeze until empty, release, allow to refill and squeeze again. Operate Manual Gas Pump for a minimum of **ONE** minute. If Manual Gas Pump **DOES NOT** refill, remove Inlet Hose Number 1, blow to remove obstructions, refit Inlet Hose Number 1 and operate pump for a minimum of **ONE** minute. Check external gas levels on LCD Screen.



TX6377 Sentry Quick Start Guide

7. When external gas level test is complete, pull Gas Inlet and Exhaust Hoses back inside refuge. Remove Gas Manifold from Sentry by unscrewing two Thumb Screws on front of Gas Manifold.



8. Repeat external gas level test when required. Use the instructions in Steps 4, 5, 6 and 7.

Checkpoint

The LCD Screen will illuminate when the Sentry is powered-up but will extinguish after **10** seconds. The LCD Screen will illuminate when an alarm is indicated or the Setup Keypad is operated.

Checkpoint

If you believe an eModule has failed, consider replacing the affected eModule. Instructions, spare parts and tools for this will be found with the Sentry. eModules can be replaced when the Sentry is powered up, underground and in use.

9. Appendix B

9.1 Sentry eModule Replacement Instructions

The following page contains the eModule Replacement Instructions TX6377-RI-EN.

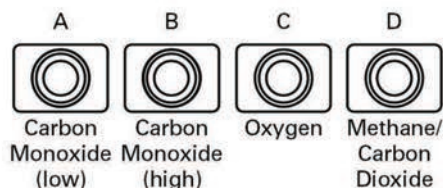
TX6377 **eModule Replacement Instructions**

TO REPLACE AN EMODULE

Checkpoint

Sentry eModules can be replaced underground even when the Sentry is powered up and in use.

1. On the front half of the Sentry use a cross head screwdriver and remove the six screws securing the front panel of the Sentry. There are three screws at the top and three at the bottom.
2. Swing the front panel out of the way. Identify the eModule(s) to be replaced.
3. The module locations are shown in the illustration below.



4. Using a flat blade screwdriver turn the module retaining screw anti-clockwise to release the defective eModule. Repeat for all eModules being replaced.
5. Remove all defective eModule(s) from the module bay.
6. Insert the replacement eModule(s) into the module bay.
7. Ensure the correct eModule is fitted in the correct location, see illustration above. The coding stops prevent the wrong eModule being fitted in the wrong module bay.
8. Ensure the connector is fully engaged and the seal on the top of the eModule is intact and firmly attached. Repeat for all affected eModules.
9. Using a flat blade screwdriver, turn the module retaining screw clockwise to secure the eModule. Repeat for all replaced eModules.
10. After fitting the eModules close the Sentry front panel and secure using the six captive screws and a cross head screwdriver.

Checkpoint

Tighten the six screws evenly to avoid the possibility of distorting the Sentry front panel. **DO NOT OVER-TIGHTEN** the six screws.

11. Ensure the Sentry is switched on.
12. Wait two minutes for the background gas concentration readings to stabilise.
13. Continue normal operation of the Sentry including testing the outside gas concentration when required.

10. Appendix C

10.1 Service and Maintenance Kit Details

10.1.1 Introduction

Maintenance of the Sentry must be carried out every 6 months as specified in section 7.1.1.

One of the tasks to be carried out every six months is to calibrate the eModules fitted to the Sentry, this is described in section 7.1.5. There are two ways this can be achieved, either by swap-out the eModules or by calibrating them whilst fitted to the Sentry.

To facilitate eModule swap-out, Trolex offers a 6 monthly module swap-out service with its Minor Service Kit, Trolex part number TX6377.02. Details of the Minor Service Kit can be found in section 10.1.2 below. Once eModules have been swapped out they can either be returned to your local Trolex service agent for calibration or calibrated out of the mine using the Base Maintenance Kit.

Where customers want the ability to calibrate their own eModules whilst fitted to the Sentry, a Base Maintenance Kit is also available from Trolex. The Base Maintenance Kit provides everything required to calibrate and test e-modules during their service life. Details of the Base Maintenance Kit can be found in section 10.1.3.

Checkpoint

The oxygen eModule must be replaced every 18 months, with all eModules replaced every 36 months, see section 7.1.1 for further details. To assist with this, two additional service kits are available. An Interim Service Kit consisting of a new, calibrated oxygen eModule and a Major Service Kit containing all four new, calibrated, replacement eModules. All eModules will be supplied with calibration certificates issued by Trolex.

10.1.2 Minor Service Kit

Minor Service Kit - Trolex part number: KS6377.02

The Minor Service Kit is required if you choose to carry out the Sentry six month eModule calibrate (task 7.1.5.1) by replacing the eModules.

You will receive a set of calibrated eModules ready to swap with the existing eModules. You either send the existing eModules back to your local Trolex service agent for calibration or calibrate them out of the mine with a set of test gases, ready for the next six month calibration task.

Following replacement of eModules you must carry out a bump test, if you do not have access to a set of test gases to perform a bump test, a canister of mixed test gas can also be supplied by Trolex. To order a canister of mixed test gas for bump testing, or get advice on sourcing test gas locally, contact **service@trolex.com**.

The Minor Service Kit (KS6377.02) contains the following:

Description	Quantity	Part No.
A set of four eModules, calibrated and ready to install	1	N/A
A calibration certificate for each eModule	1	N/A
A pre-addressed Jiffy bag for return of the removed eModules to Trolex	1	N/A
IPR number for return of goods through customs	1	N/A
Instruction leaflet describing how to install the eModules	1	N/A

This kit can be ordered from Trolex Product Support via: **service@trolex.com**

10.1.3 Base Maintenance Kit

Base Maintenance Kit - Trolex part number: KS6377.01

The Base Maintenance Kit is required if you choose to carry out the Sentry six month eModule calibrate (task 7.1.5.2) using test gas applied directly to the eModules. You will also need the Base Maintenance Kit if you choose to calibrate swapped-out eModules using test gases instead of returning them to your local Trolex service agent.

In addition to the Base Maintenance Kit, you will also require calibration gases and gas regulators as detailed below. These can be obtained locally or from your local Trolex service agent. Further details are available from **service @trolex.com**. You may also wish to purchase a spare set of eModules to enable a rolling calibration program.

The Base Maintenance Kit (KS6377.01) contains the following:

Description	Quantity	Part No.
Sentro test rig	1	P5550.03.01
Sentry battery charger	1	TX6377.51
Sentry User Manual	1	TX6377-UM-EN
Video or Skype training session from service and support	1	N/A
Sample copy of a calibration certificate	1	N/A

Checkpoint

Customers should be aware of the lifespan of eModules as listed in the User Manual section 7.1.1. The oxygen eModule must be replaced every 18 months using the Interim Service Kit and all eModules are replaced after 36 months using the Major Service Kit (KS6377.04).

Optional Items

The following test gases and associated equipment are also required to enable calibration of the e-modules either in the mine or in the Sentro test rig. The gases may be purchased locally or can be ordered from Trolex. These test gases are available from Trolex in the sizes, 34 litre (9 US gal.), 58 litre (15.5 US gal.) or 110 litre (29 US gal.). For advice on ordering gases contact **service@trolex.com**.

Test Gases

Description	Quantity	Part No.
Carbon dioxide 4%v/v in balanced air or nitrogen	A/R	N/A
Carbon monoxide 50ppm in balanced air	A/R	N/A
Carbon monoxide 500ppm in balanced air	A/R	N/A
Methane 100% v/v	A/R	N/A
Methane 2.5% v/v in balanced air or nitrogen	A/R	N/A
Oxygen 23% in balanced nitrogen	A/R	N/A
Nitrogen 100%	A/R	N/A

Associated Equipment

Description	Quantity	Part No.
Gas regulators to suit the above test gas cylinders	A/R	N/A
PTFE tubing, 4 mm internal and 6 mm external diameters	A/R	N/A
Trolex gas hood	A/R	P5536.07

10.1.4 Interim Service Kit

The oxygen eModule must be replaced every 18 months. You will receive a calibrated eModule ready to install, complete with calibration certificate. Dispose of the replaced eModule in accordance with the instructions in section 7.6.

The Interim Service Kit (KS6377.03) contains the following:

Description	Quantity	Part No.
Trolex Sentro eModule - oxygen, complete with calibration certificate	1	TX6350.01.257S

10.1.5 Major Service Kit

All four eModules and the rear half battery pack must be replaced every 36 months. You will receive a set of four calibrated eModules ready to install complete with a calibration certificate for each eModule. Dispose of the replaced eModules and rear half battery pack in accordance with the instructions in section 7.6.

The Major Service Kit (KS6377.04) contains the following:

Description	Quantity	Part No.
Trolex Sentry eModule - carbon dioxide and methane, complete with calibration certificate	1	TX6350.01.247
Trolex Sentry eModule - carbon monoxide 50ppm, complete with calibration certificate	1	TX6350.01.250 .50S
Trolex Sentry eModule - carbon monoxide 1000ppm, complete with calibration certificate	1	TX6350.01.250 .1000S
Trolex Sentro eModule - oxygen, complete with calibration certificate	1	TX6350.01.257S
Sentry User Manual	1	TX6377-UM-EN
Sentry rear half battery pack	1	TX6377.50

11. Appendix D

Checkpoint

The deployment and use of the TX6377 Sentry will depend on the design of the refuge alternative in which it is to be used. The following information is provided as an example only.

11.1 Example Deployment and Use of TX6377 Sentry in Refuge Alternative covered by 30CFR Parts 7 & 75

When the TX6377 Sentry is to be deployed it must first be removed from the airtight, waterproof and rodent-proof storage container. The unit is activated by pushing the power button on the top of the battery module. On power-up the unit enters a warm-up routine and within 2 minutes automatically displays the measured gas concentrations on the LCD. During this period the sealing bungs are to be removed from the manifold and the sampling tubes and hand-pump fitted to the manifold (refer to Sentry Quick Start Guide - TX6377-QS-EN-01).

The TX6377 Sentry is suitable for both refuge alternative designs that incorporate an airlock and refuge alternative designs that do not incorporate an airlock.

11.1.1 Refuge Alternative with Airlock

Monitoring Atmosphere within the Airlock

If required by the refuge alternative manufacturer, check the gas concentration in the airlock.

This measurement is carried out with the TX6377 Sentry in the airlock with the miners who use the hand-pump to draw a sample of the atmosphere into the manifold (refer to Sentry Quick Start Guide - TX6377-QS-EN-01). The channel B carbon monoxide and channel D methane readings on the display give these measurements.

Checkpoint

With the manifold fitted, the carbon monoxide low reading on channel A will indicate zero as the sampled atmosphere is not applied to this sensor. This protects the sensor from possible exposure to very high concentrations of gas.

If necessary, purge the airlock in accordance with the instructions supplied by the refuge alternative manufacturer. The first group of miners can move from the airlock into the main chamber. If further groups of miners are waiting to access the refuge alternative the TX6377 Sentry can temporarily remain in the airlock for each group to use in the same way. The last group of miners to enter should transfer the TX6377 Sentry into the main chamber with them to enable the atmosphere within the chamber to be monitored (see section below).

If further groups of miners arrive later the airlock atmosphere can be monitored by those within the main chamber by using the TX6377 Sentry with the manifold and hand-pump. The sampling tubes (sample and exhaust) are placed through holes in the chamber/airlock wall provided by the refuge alternative manufacturer for this purpose. Those carrying out the sampling from within the main chamber indicate to the miners in the airlock whether the measured concentrations permit them to enter the main chamber or whether the airlock must be purged.

Monitoring Atmosphere within the Main Chamber

30CFR 75.1506 (i) requires that the atmosphere within the main chamber is monitored and changes or adjustments made to maintain the following concentrations,

Methane	< 1%
Carbon Dioxide	< 1% (excursions <2.5%)
Carbon Monoxide	< 25ppm
Oxygen	18.5 to 23%

When measuring the atmosphere within the main chamber the manifold is removed. This allows the atmosphere to reach the sensors by diffusion without the need to operate the hand-pump. It also allows the atmosphere to be measured by the low level carbon monoxide sensor whose reading is indicated by the channel A carbon monoxide display.

The TX6377 Sentry has audio and visual alarms which can be preset by the user during initial configuration (refer to User Manual). These can be set to alert the user when the limits are approached to enable the necessary adjustments to be made to keep the atmosphere within the permitted concentrations. Adjustments to the atmosphere are made using the system provided by the refuge alternative manufacturer.

Monitoring Atmosphere Outside the Structure

30CFR 7.507 (a) requires that the air-monitor has the ability to determine the concentrations of carbon dioxide, carbon monoxide, oxygen and methane outside the structure. This is done with the TX6377 Sentry by fitting the manifold and using the hand-pump to draw a sample of atmosphere from outside the structure using holes in the wall provided by the refuge alternative manufacturer for this purpose. The level of carbon monoxide reading is indicated by the channel B carbon monoxide display. During this measurement the sample must be exhausted outside the structure.

11.1.2 Refuge Alternative without Airlock

Monitoring Atmosphere within the Chamber

The TX6377 Sentry is taken directly into the chamber with the miners. If required by the refuge alternative manufacturer, check the gas concentration in the chamber.

This measurement is carried out with the TX6377 Sentry by using the hand-pump to draw a sample of the atmosphere into the manifold (refer to Sentry Quick Start Guide - TX6377-QS-EN-01). The channel B carbon monoxide and channel D methane readings on the display give these measurements.

Checkpoint

With the manifold fitted, the carbon monoxide low reading on channel A will indicate zero as the sampled atmosphere is not applied to this sensor. This protects the sensor from possible exposure to very high concentrations of gas.

If necessary, purge the chamber in accordance with the instructions supplied by the refuge alternative manufacturer.

At this point the manifold is removed from the TX6377 Sentry to allow the atmosphere to reach the sensors by diffusion (without the need to operate the hand-pump) and to allow the atmosphere to be measured by the low level carbon monoxide sensor whose reading is indicated by the channel A carbon monoxide display. 30CFR 75.1506 (i) requires that the atmosphere within the main chamber is monitored and changes or adjustments made to maintain the following concentrations,

Methane	< 1%
Carbon Dioxide	< 1% (excursions <2.5%)
Carbon Monoxide	< 25ppm
Oxygen	18.5 to 23%

The TX6377 Sentry has audio and visual alarms which can be preset by the user during initial configuration (refer to User Manual). These can be set to alert the user when the limits are approached to enable the necessary adjustments to be made to keep the atmosphere within the permitted concentrations. Adjustments to the atmosphere are made using the system provided by the refuge alternative manufacturer.

Monitoring Atmosphere Outside the Structure

30CFR 7.507 (a) requires that the air-monitor has the ability to determine the concentrations of carbon dioxide, carbon monoxide, oxygen and methane outside the structure. This is done with the TX6377 Sentry by fitting the manifold and using the hand-pump to draw a sample of atmosphere from outside the structure using holes in the wall provided by the refuge alternative manufacturer for this purpose. The level of carbon monoxide reading is indicated by the channel B carbon monoxide display. During this measurement the sample must be exhausted outside the structure.

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When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

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